

IMPORTANCE AND MEASURES OF HEALTH PROTECTION OF HONEY BEES IN MONTENEGRO

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Abstract

Beekeeping in Montenegro has a long tradition. Today, this activity has great significance not only for the preservation of nature, but also for the development of Montenegro's economy. Because of the diversity of honey plants (over 500 species), Montenegrin honey is of high quality, both in nutrition and in healing properties.

Health protection of bees has a great importance for the development of beekeeping. Particular attention is focused on the prevention and suppression of infectious diseases of bees caused by bacteria, fungi and viruses, as well as parasitic diseases that most often cause mites. In Montenegro, according to the law, seven diseases of bees are prevented and suppressed, which are on the list of dangerous infectious diseases of the OIE. The most serious infectious disease of bees is the American foulbrood of honey bees caused by *Paenibacillus larvae*. Therapy of this disease is not carried out - it is not allowed by law and diseased bee societies are destroyed. Fungal disease - the nosemosis caused by *Nosema apis* in Montenegro, also causes significant losses in beekeeping in Montenegro. Of parasitic diseases of honey bees in Montenegro, varroosis caused by mites *Varroa destructor* occurs. Varroosis also causes enormous consequences for the health of bee societies in Montenegro. The program of mandatory animal health measures implemented every year in Montenegro establishes preventive measures aimed at: monitoring, preventing, detecting, suppressing and eradicating infectious and parasitic diseases of bees. Non-infectious diseases of honey bees also have great significance for the beekeeping of Montenegro. Of these, the most significant is the poisoning of bees. The most dangerous poisons for bees are insecticides that are uncontrolled and incorrectly used in agriculture.

In order to preserve the health of bee colonies and increase yields of honey, pollen, royal jelly and propolis, necessary are: regular health control of beekeepers, compliance with legal regulations and strict application of apitechnical measures. The education of beekeepers should focus on the implementation of hygiene measures on beehives, preventive measures and the way to control bee diseases, proper nutrition, bee technology and the importance of quality and health correctness of honey and other bee products.

Key words: Beekeeping, Honey bee, Honey bee diseases, Crna Gora, Montenegro.

1. Introduction

1.1 Basic characteristics of beekeeping in Montenegro

Beekeeping in Montenegro has a long tradition and it was mainly a secondary human activity. The first association of beekeepers in Montenegro was founded in 1934 in Rijeka Crnojevića, but organized beekeeping in Montenegro is making significant progress only after the end of the Second World War. Today, this activity has great significance not only for the preservation of nature, but also for the development of Montenegro's economy. In recent years, interest in organic beekeeping is growing [1, 2]. In Montenegro being raised the autochthonous race of honey bee *Apis Mellifera* var. *carnica* (kranjska, gray or domestic karnika), which has very good biological and production properties (Figure 1). It is represented on the entire Balkan Peninsula. The bee societies of this race are calm, well-wintered, have a fast spring development and are economical in the consumption of food. They cover honey with white lids, so they are also significant for the production of honey in the honeycomb [3, 4].

Due to the presence of several climatic zones, the distribution of meadows and pastures rich in various honey plants (over 500 species), beekeeping can be developed in all parts of Montenegro. Bearing in mind the differences in the climate and the presence of honey plants, each region in Montenegro has its own specificities regarding the beekeeping development. About 40% of the beehives are of migratory character, which is especially expressed in the southern parts of Montenegro. In the northern regions, bee-keeping is mostly stationary, and the mountain climate characterized by long and cold winters causes a decrease in bee activity [2]. Because of the diversity of honey plants, Montenegrin honey is of high quality, both in nutrition and in healing properties. Some of the most significant honey plants are: wormwood (*Artemisia absinthium*), sage (*Salvia officinalis*), willow (*Salix* spp.), cornelian cherry (*Cornus mas*), white clover (*Trifolium repens*), red clover (*Trifolium pratense*), wild thyme (*Thymus serpyllum*), silver linden (*Tilia mentosa*), bigleaf linden (*Tilia platyphyllos*), Jerusalem thorn (*Paliurus spina - christi*), bilberry (*Vaccinium myrtillus*), mountain savory (*Satureja montana*), common horehound (*Marrubium vulgare*), mint (*Mentha* spp.), dandelion (*Taraxacum* spp.), chestnut (*Castanea* spp.), common laburnum (*Laburnum anagyroides*), conifers (order *Pinales*) and others. Production of wax, pollen, propolis and royal jelly in Montenegro is small, while the bee poison is not produced. All of these affects the overall economic benefits of beekeeping in Montenegro [2].

2. Importance and measures of health protection of honey bees in Montenegro

2.1 Importance of health care of honey bees in Montenegro

Health protection of bees has a great importance for the development of beekeeping. Particular attention is focused to the prevention and control of infectious diseases of bees caused by bacteria, fungi and viruses. Of paramount importance are parasitic diseases, which primarily cause ticks. In Montenegro, seven diseases of bees which are on the list of dangerous infectious diseases of the OIE are compulsorily regulated by law [5, 6]. Dangerous infectious diseases are diseases that can cause negative socio-economic consequences and negative consequences for public health in the country, and in international trade in animals and products of animal origin [7]. When speaking about the dangerous bacterial diseases of the bees, these are: american and european foulbrood of honey bees, from fungal diseases - the noseosis of honey bees, and from parasitic diseases: varroosis, acarapisosis, tropilaelaps infestation of honey bees (tropilelosis) and small hive beetle infestation (ethiniosis) [5].



Figure 1. "Kranjska" bee (*A. mellifera carnica*)



Figure 2. The extinction of dead larvae in the american foulbrood of honey bees

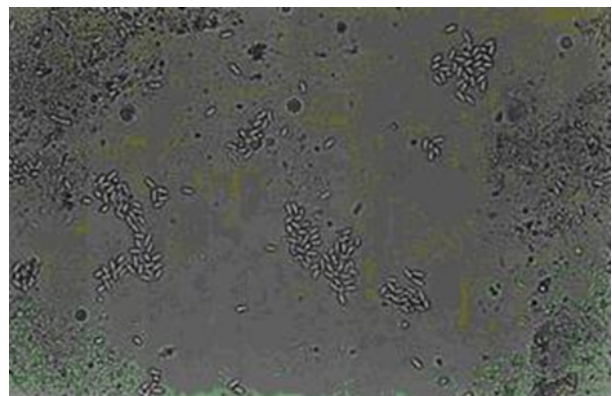


Figure 3. Spore *Nosema apis*, oval shape - like rice grain (native preparation, 400 x), found in the bee excrement (Source: Bojanić Rašović)

The most serious infectious disease of bee societies is the american foulbrood of honey bees caused by the *Paenibacillus larvae* bacteria. The illness is manifested by changes in the covered bee litter (Figure 2). Adult bees do not get sick. Therapy of this disease is not carried out - it is forbidden by law and diseased bee societies have to be destroyed [3, 8, 9, and 10].

European foulbrood of honey bees, also dangerous bacterial disease is not yet diagnosed in Montenegro. This is a contagious disease on primarily open, less

closed litters caused by a Gram positive round bacteria *Melissococcus plutonius*. Fungal disease - the nosemosis, caused by *Nosema apis* in Montenegro, causes significant losses in beekeeping in Montenegro [1, 2]. This microorganism was previously classified into protozoa; the classification has changed since molecular methods have found its greater similarity to fungi [11]. Causative agent attacks epithelial cells wall of the medium intestine of the queen bee, worker bees and drones; also it can affect other organs (Figure 3). For treatment, iodine-based preparations (Nozucid), natural non-toxic preparations such as KAS-81, and preparation on the basis of herbal polyphenols (Nozevit) are used. The use of fumagillin DCH is prohibited [1, 3, and 12].

Varroa destructor is causative agent of parasitic diseases of honey bees in Montenegro (Figure 4). Varroosis have an enormous negative impact on the health of bee companies in Montenegro [1, 2]. This parasite causes direct damage (it feeds on bees hemolymph) and it quickly becomes resistant to administered drugs. Because of that, there are no completely effective drugs that can effectively eliminate this disease. If timely protective measures are not taken, a large number of parasites lead to the apiary destruction [3, 13, 14]. Indirect damage from this parasite is reflected in the transmission of viral diseases to the bee societies. For the treatment of varroa in Montenegro, the medicine "Apiguard" is used - where the active substance is thymol. Alternatively, formic acid, Api Life Var, Thymovar, oxalic acid, thymol alcohol solution are used [1].

A parasitic disease acarapisosis, caused by the *Acarapis woodi* mites, is not yet diagnosed in Montenegro. Parasites can be found in the trachea, sometimes on the bees wings wrist; it is fed on the bee hemolymph. Also not diagnosed in Montenegro is dangerous infectious diseases tropilaelaps infestation (tropilelosis, caused by mites *Tropilaelaps* spp.) and small hive beetle infestation (ethiniosis, caused by small hive beetle *Aethina tumida*).



Figure 4. *Varroa destructor*, bees parasite, magnification 200 x
(Source: Bojanić Rasović)

Bees mass disappearance - *Colony collapse disorder* (CCD) is still not present in Montenegro; this disease causes significant losses in Europe and in the surroundings [1, 3]. The real cause of this disease has not yet been established. It is thought that many factors influence on the disease occurrence, as: treating plants with pesticides, bees grazing on genetically modified plants, various sources of electromagnetic radiation, viruses, etc. The diseased bees do not return to the beehives and are dying at unknown places [3].

Bees non-infectious diseases also have an great significance for the beekeeping of Montenegro. The most significant of these diseases is the bees poisoning. The most dangerous poisons for bees are insecticides that are uncontrollably and incorrectly used in agriculture. Irregular and untimely treatment of diseased bee societies with chemical preparations reduces the bees resistance, and often used preparations are leaving residues in wax and honey, which disrupts the products safety [15, 16].

2.2 Measures of health protection of honey bees in Montenegro

The program of mandatory animal health measures which is implemented every year in Montenegro establishes preventive measures aimed at monitoring, preventing, detecting, suppressing and eradicating infectious and parasitic diseases of bees. Responsible institutions for the implementation of these measures are the Ministry of agriculture and rural development - the Directorate for food safety, veterinary and phytosanitary affairs, veterinary clinics and the specialist veterinary laboratory. Measures include all bee societies in Montenegro. In order to effectively monitor bees health, the Register of Beekeepers and apiaries is maintained by the Directorate for food safety. Beekeepers are obliged to regularly check the bee societies in the apiary, and changes that are suspicious of a disease are reported to the veterinary service, in accordance with

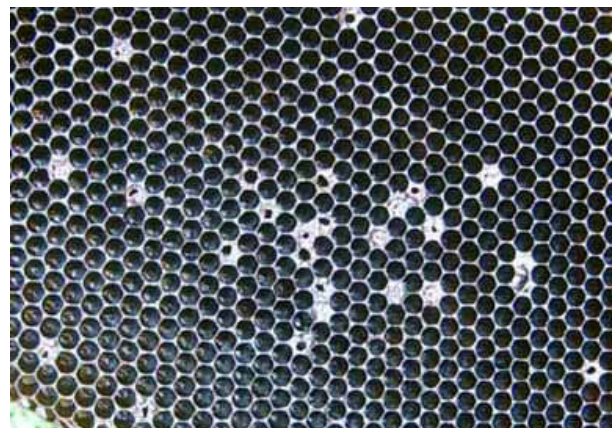


Figure 5. Scattered covered bee litter

the veterinary law. The beekeeper should also keep records of the conducted preventive and diagnostic measures. Breeding of queen bee is performed at registered apiaries under veterinary supervision. Clinical examinations of all bee societies is performed in the spring and autumn [8, 17]. Lids of the bee litter appearance are of the great importance in the detection of infectious diseases. Incorrectly arranged, covered and uncovered litter is often a sign of the presence of infectious diseases of the bee's litter (Figure 5).

In case of doubt about the presence of the american foulbrood of honey bees, a clinical examination of all bee societies and laboratory testing of samples taken from each suspicious bee societies is performed. It is also necessary to determine the age of the pathological process in samples positive for the presence of the *Paenibacillus larvae*. A piece of honeycomb with a covered litter of 10 cm x 10 cm in size, on which the signs of the disease are well visible, in the appropriate paper packaging is delivered for inspection. Since the diseases of adult bees are unnoticed for a long time (most often they die in nature), it is very important to regularly send bees samples to laboratory testing [3, 18, and 19].

Beekeepers, veterinary staff and subjects in the honey business of and other bee products, according to the veterinary law are also obliged to implement prescribed preventive measures when used veterinary medicines and other substances that can be transferred to honey, in order to prevent the occurrence of illicit residues in honey. It is forbidden to place on the market honey containing the residues [7, 20, and 21]. Veterinarian may only use medicinal products that have an authorization, and medicines should be used only in the accordance with the manufacturer's instructions. A veterinarian who treats bees is obliged to keep a treatment record. Beekeeper is obliged to apply the prescribed veterinary medicines only with the approval and control of the veterinarian, as well as adhering to the instructions of the medicines manufacturers and the prescribed waiting period. An improper method of breeding often leads to the emergence and spread of diseases of bees and bees litter [22, 23]. When transferring honeycomb frames from one beehive to another, the beekeeper often transmits the causes of infectious and parasitic diseases. Application of good beekeeping practice and HACCP in Montenegro's beekeeping is still at an unsatisfactory level, which significantly contributes to the appearance and spread of bee diseases [24, 25].

3. Conclusions

- In order to preserve the bee colonies health and increase yields of honey, pollen, royal jelly and propolis, necessary measures are regular health control of beekeepers, compliance with legal regulations, and strict application of apitechnical measures.

- Education of beekeepers should focus on the implementation of hygiene measures on beehives, preventive measures and the way to bee diseases control, proper nutrition, bee technology, and the importance of quality and safety of honey and other bee products.

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